

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

K-1974

Applicant : Mitsuhiro Nishida et al
Title : ANTIREFLECTION FILM
Serial No. :
Filed : April 19, 2001
Group Art Unit :

Hon. Commissioner of Patents and Trademarks
Washington, D. C. 20231

April 19, 2001

PRELIMINARY AMENDMENT

Sir:


Preliminary to examination, please amend the claims 3, 5, 6, 7, 9, 14, 15, 18, 19, 20, 22, 25, 26 and 27 as attached herewith.

REMARKS

The preliminary amendment has been filed to change multiple dependency of claims 3, 5, 6, 7, 9, 14, 15, 18, 19, 20, 22, 25, 26 and 27 to single dependency.

Respectfully submitted,

KANESAKA AND TAKEUCHI

by 
Manabu Kanesaka
Reg. No. 31,467
Agent for Applicants

1423 Powhatan Street
Alexandria, Virginia 22314
(703) 519-9785

What is claimed is:

1. An antireflection film comprising:
an organic film,
a hard coating layer coated on the organic film,
a layer having high index of refraction coated on the hard coating layer, and
a surface layer made of organic resin having excellent marring resistance and
chemical resistance coated on the layer having high index of refraction,
each of said layers being made of synthetic resin thin film.
2. An antireflection film as claimed in claim 1, wherein said hard coating
layer has a thickness in a range of 2 to 20 μm , said layer having high index of
refraction has a thickness in a range of 75 to 95nm, and said surface layer made of
organic resin having excellent marring resistance and chemical resistance has a
thickness in a range of 85 to 110nm.
3. (Amended) An antireflection film as claimed in claim 1, wherein said synthetic
resin is ultraviolet ray curable resin or electron beam curable resin.
4. An antireflection film as claimed in claim 3, wherein said synthetic resin is
multifunctional acrylic resin.
5. (Amended) An antireflection film as claimed in claim 1, wherein said hard
coating layer has electrical conductivity.
6. (Amended) An antireflection film as claimed in claim 1, wherein said layer
having high index of refraction has electrical conductivity.
7. (Amended) An antireflection film as claimed in claim 5, wherein said layers
have electrical conductivity by including electrically conductive metallic oxide.
8. An antireflection film as claimed in claim 5, wherein the visible light
transmittance of said hard coating layer is not smaller than 85% and the surface electrical
resistance of said hard coating layer is not greater than $5 \times 10^{10} \Omega/\square$.
9. (Amended) An antireflection film as claimed in claim 1, wherein said synthetic
resin is acrylic resin.
10. An antireflection film as claimed in claim 5, wherein the index of refraction of
the layer having high index of refraction is not smaller than 1.70.
11. An antireflection film as claimed in claim 5, wherein the index of refraction of

the layer having high index of refraction is not smaller than 1.75.

12. An antireflection film as claimed in claim 6, wherein the index of refraction of the layer having high index of refraction is not smaller than 1.64.

13. An antireflection film as claimed in claim 6, wherein the index of refraction of the layer having high index of refraction is not smaller than 1.69.

14. (Amended) An antireflection film as claimed in claim 1, wherein the index of refraction of said surface layer is from 1.45 to 1.51.

15. (Amended) An antireflection film as claimed in claim 1, wherein said surface layer includes minute particles which have low friction coefficients.

16. An antireflection film comprising:
an organic film,
a hard coating layer coated on the organic film,
a layer having high index of refraction coated on the hard coating layer, and
a layer having low index of refraction coated on the layer having high index of refraction,
said layer having high index of refraction consisting of synthetic resin thin film including metallic oxide particles,
said metallic oxide being at least one selected from a group consisting of ZrO_2 , TiO_2 , NbO , ITO , ATO , SbO_2 , In_2O_3 , SnO_2 and ZnO , and
said synthetic resin being ultraviolet ray curable resin or electron beam curable resin.

17. An antireflection film as claimed in claim 16, wherein the amount of said metallic oxide particles contained in said layer having high index of refraction is not smaller than 70wt. %.

18. (Amended) An antireflection film as claimed in claim 16, wherein sizes of said metallic oxide particles are not greater than $0.1\mu\text{m}$.

19. (Amended) An antireflection film as claimed in claim 16, wherein said synthetic resin is acrylic resin.

20. (Amended) An antireflection film as claimed in claim 16, wherein a part of material for use in forming the layer having low index of refraction penetrates into said layer having high index of refraction.

21. An antireflection film as claimed in claim 20, wherein the amount of said material penetrated into said layer having high index of refraction is not smaller than

10vol. %.

22. (Amended) An antireflection film as claimed in claim 16, wherein a part of said antireflection film is produced as follows: after a porous precursory layer of said layer having high index of refraction is formed, liquid material to make the layer having low index of refraction is coated on said precursory layer and a part of said material to make the layer having low index of refraction penetrates into said precursory layer, and then said material is hardened.

23. An antireflection film as claimed in claim 22, wherein said precursory layer becomes a porous layer including air after the solvent is dried or crosslinked.

24. An antireflection film as claimed in claim 23, wherein void fraction of said precursory layer is not smaller than 10vol. %.

25. (Amended) An antireflection film as claimed in claim 22, wherein the index of refraction of said precursory layer is not greater than 1.64 and the index of refraction of said layer having high index of refraction is not smaller than 1.64.

26. (Amended) An antireflection film as claimed in claim 16, wherein the index of refraction of the layer having low index of refraction is in a range from 1.45 to 1.51.

27. (Amended) An antireflection film as claimed in claim 16, wherein said layer having low index of refraction includes minute particles which have excellent marring resistance and low coefficients of friction.

28. An antireflection film as claimed in claim 27, wherein said minute particles having excellent marring resistance and low coefficient of friction are composed of silica or fluorocarbon polymers.

What is claimed is:

1. An antireflection film comprising:
an organic film,
a hard coating layer coated on the organic film,
a layer having high index of refraction coated on the hard coating layer, and
a surface layer made of organic resin having excellent marring resistance and
chemical resistance coated on the layer having high index of refraction,
each of said layers being made of synthetic resin thin film.
2. An antireflection film as claimed in claim 1, wherein said hard coating
layer has a thickness in a range of 2 to 20 μm , said layer having high index of
refraction has a thickness in a range of 75 to 95nm, and said surface layer made of
organic resin having excellent marring resistance and chemical resistance has a
thickness in a range of 85 to 110nm.
- ~~(amended)~~ 3. An antireflection film as claimed in claim 1 [or 2], wherein said synthetic
resin is ultraviolet ray curable resin or electron beam curable resin.
4. An antireflection film as claimed in claim 3, wherein said synthetic resin is
multifunctional acrylic resin.
- ~~(amended)~~ 5. An antireflection film as claimed in [any one of claims 1 through 4] claim 1,
wherein said hard coating layer has electrical conductivity.
- ~~(amended)~~ 6. An antireflection film as claimed in [any one of claims 1 through 4] claim 1,
wherein said layer having high index of refraction has electrical conductivity.
- ~~(amended)~~ 7. An antireflection film as claimed in claim 5 [or 6], wherein said layers have
electrical conductivity by including electrically conductive metallic oxide.
8. An antireflection film as claimed in claim 5, wherein the visible light
transmittance of said hard coating layer is not smaller than 85% and the surface electrical
resistance of said hard coating layer is not greater than $5 \times 10^{10} \Omega/\square$.
- ~~(amended)~~ 9. An antireflection film as claimed in [any one of claims 1 through 8] claim 1,
wherein said synthetic resin is acrylic resin.
10. An antireflection film as claimed in claim 5, wherein the index of refraction of
the layer having high index of refraction is not smaller than 1.70.
11. An antireflection film as claimed in claim 5, wherein the index of refraction of

the layer having high index of refraction is not smaller than 1.75.

12. An antireflection film as claimed in claim 6, wherein the index of refraction of the layer having high index of refraction is not smaller than 1.64.

13. An antireflection film as claimed in claim 6, wherein the index of refraction of the layer having high index of refraction is not smaller than 1.69.

~~(amended)~~
14. An antireflection film as claimed in [any one of claims 1 through 13] claim 1, wherein the index of refraction of said surface layer is from 1.45 to 1.51.

~~(amended)~~
15. An antireflection film as claimed in [any one of claims 1 through 14] claim 1, wherein said surface layer includes minute particles which have low friction coefficients.

16. An antireflection film comprising:
an organic film,
a hard coating layer coated on the organic film,
a layer having high index of refraction coated on the hard coating layer, and
a layer having low index of refraction coated on the layer having high index of refraction, said layer having high index of refraction consisting of synthetic resin thin film including metallic oxide particles,
said metallic oxide being at least one selected from a group consisting of ZrO_2 , TiO_2 , NbO , ITO , ATO , SbO_2 , In_2O_3 , SnO_2 and ZnO , and
said synthetic resin being ultraviolet ray curable resin or electron beam curable resin.

17. An antireflection film as claimed in claim 16, wherein the amount of said metallic oxide particles contained in said layer having high index of refraction is not smaller than 70wt %.

~~(amended)~~
18. An antireflection film as claimed in claim 16 [or 17], wherein sizes of said metallic oxide particles are not greater than $0.1\mu\text{m}$.

~~(amended)~~
19. An antireflection film as claimed in [any one of claims 16 through 18] claim 16, wherein said synthetic resin is acrylic resin.

~~(amended)~~
20. An antireflection film as claimed in [any one of claims 16 through 19] claim 16, wherein a part of material for use in forming the layer having low index of refraction penetrates into said layer having high index of refraction.

21. An antireflection film as claimed in claim 20, wherein the amount of said material penetrated into said layer having high index of refraction is not smaller than

10vol. %.

~~22.~~ ^{amended} An antireflection film as claimed in [any one of claims 16 through 21] claim 16, wherein a part of said antireflection film is produced as follows: after a porous precursory layer of said layer having high index of refraction is formed, liquid material to make the layer having low index of refraction is coated on said precursory layer and a part of said material to make the layer having low index of refraction penetrates into said precursory layer, and then said material is hardened.

23. An antireflection film as claimed in claim 22, wherein said precursory layer becomes a porous layer including air after the solvent is dried or crosslinked.

24. An antireflection film as claimed in claim 23, wherein void fraction of said precursory layer is not smaller than 10vol. %.

~~25.~~ ^{amended} An antireflection film as claimed in [any one of claims 22 through 24] claim 22, wherein the index of refraction of said precursory layer is not greater than 1.64 and the index of refraction of said layer having high index of refraction is not smaller than 1.64.

~~26.~~ ^{amended} An antireflection film as claimed in [any one of claims 16 through 25] claim 16, wherein the index of refraction of the layer having low index of refraction is in a range from 1.45 to 1.51.

~~27.~~ ^{amended} An antireflection film as claimed in [any one of claims 16 through 26] claim 16, wherein said layer having low index of refraction includes minute particles which have excellent marring resistance and low coefficients of friction.

28. An antireflection film as claimed in claim 27, wherein said minute particles having excellent marring resistance and low coefficient of friction are composed of silica or fluorocarbon polymers.